

PCT

JC17 Rec'd PCT/PTO 18 JUN 2001

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE FORM PTO-1390 REV. 11-98		ATTORNEY'S DOCKET NUMBER 4117 US
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/868606
INTERNATIONAL APPLICATION NO. PCT/EP99/09885	INTERNATIONAL FILING DATE December 14, 1999	PRIORITY DATE CLAIMED December 23, 1998
TITLE OF INVENTION MULTIPOLE ELECTRIC MOTOR AND PROCESS FOR ITS PRODUCTION		
APPLICANT(S) FOR DO/EO/US Heinrich-Jochen Blume, et al		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). (PCT/IPEA/401)</p> <p>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. /</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. (PCT/IB/308)</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). (11 pages including abstract)</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input type="checkbox"/> have been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or/declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (3 pages) ^{unsigned}</p> <p>10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p>		
Items 11. to 16. below concern document(s) or information included:		
<p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98, PTO-1449, and copy (EPO) International Search Report - 3 pages in English listing references and their relevance, and 2 references from German Patent Office Action.</p> <p>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. *Enter Preliminary Amendment before calculating claim fees</p> <p><input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>14. <input type="checkbox"/> A substitute specification.</p> <p>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>16. <input checked="" type="checkbox"/> Other items or information: WO 00/39909 (cover page)</p> <p>17. <input checked="" type="checkbox"/> PCT/IPEA/401</p> <p>18. <input checked="" type="checkbox"/> PCT/IB/308</p> <p>19. <input checked="" type="checkbox"/> CLAIM IS HEREBY MADE OF THE BENEFIT OF THE FILING DATE OF Germany Patent Application 198 60 111.5 filed December 23, 1998 UNDER USC 119</p> <p>20. <input checked="" type="checkbox"/> Express Mail mailing label No. EJ450234769US deposited June 18, 2001</p>		

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)		INTERNATIONAL APPLICATION NO. PCT/EP99/09885	ATTORNEY'S DOCKET NUMBER 4117 US																				
<p>17. <input checked="" type="checkbox"/> The following fees are submitted:</p> <p>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$970.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$760.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00</p>		CALCULATIONS PTO USE ONLY																					
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<p>Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).</p>		\$																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>CLAINS</th> <th>NUMBER FILED</th> <th>NUMBER EXTRA</th> <th>RATE</th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>25</td> <td>- 20 =</td> <td>\$ 90.00</td> </tr> <tr> <td>Independent claims</td> <td>2</td> <td>- 3 =</td> <td>\$ 0</td> </tr> <tr> <td colspan="2">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td>*</td> <td>\$ 0</td> </tr> <tr> <td colspan="2" style="text-align: center;">TOTAL OF ABOVE CALCULATIONS</td> <td style="text-align: center;">\$ 950.00</td> <td></td> </tr> </tbody> </table>		CLAINS	NUMBER FILED	NUMBER EXTRA	RATE	Total claims	25	- 20 =	\$ 90.00	Independent claims	2	- 3 =	\$ 0	MULTIPLE DEPENDENT CLAIM(S) (if applicable)		*	\$ 0	TOTAL OF ABOVE CALCULATIONS		\$ 950.00		\$	
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<p>Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property</p>		\$																					
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<p>a. <input checked="" type="checkbox"/> A check/in the amount of <u>\$950.00</u> to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>06-0105</u>. A duplicate copy of this sheet is enclosed.</p>																							
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p> <p>*Enter Preliminary Amendment before calculating claim fees</p>																							
SEND ALL CORRESPONDENCE TO: MARTIN A. FARBER 866 United Nations Plaza, Suite 473 New York, NY 10017 Tel (212) 758-2878 Fax (212) 758-2913		 SIGNATURE: MARTIN A. FARBER NAME Reg. No. 22,345 REGISTRATION NUMBER																					

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Express Mail mailing label No. EJ450234769US
Deposited June 18, 2001

USA National Stage Patent Application
PCT/EP99/09885 filed December 14, 1999
Heinrich-Jochen Blume, et al
MULTIPOLE ELECTRIC MOTOR AND
PROCESS FOR ITS PRODUCTION

Priority: German Patent Application
198 60 111.5 filed December 23, 1998

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R :

PRELIMINARY AMENDMENT

Please amend this application simultaneously with filing the
accompanying translation and this USA National Stage application
as follows:

IN THE ABSTRACT

Cancel the Abstract and replace it with the new Abstract attached
herewith on a separate page.

IN THE SPECIFICATION

Page 1, Line 5, before this line insert the following paragraph
heading:

FIELD AND BACKGROUND OF THE INVENTION

Page 1, Line 31, before this line insert the following paragraph heading:

SUMMARY OF THE INVENTION

Page 4, Line 3, before this line insert the following paragraph heading:

BRIEF DESCRIPTION OF THE DRAWINGS

Page 4, Line 23, before this line insert the following paragraph heading:

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

IN THE CLAIMS

Before claim 1, change "Patent claims" to --WE CLAIM:--

Please cancel claims 1-25 without prejudice or disclaimer of the subject matter therein and substitute the following claims 26-50 therefor:

26. (new) A multipole electric motor with a rotor and a stator, comprising a plurality of coils and stator laminations which are magnetically separated from one

another and respectively extend from the coils to the rotor, wherein the stator laminations (1, 2, 3, 4) are connected in a region facing the rotor (19) to a holder (11) of non-magnetic metal.

27. (new) The electric motor as claimed in claim 26, wherein the stator laminations (1, 2, 3, 4) are galvanized.

28. (new) The electric motor as claimed in claim 27, wherein the stator laminations (1, 2, 3, 4) are welded to the holder (11) of the non-magnetic metal.

29. (new) The electric motor as claimed in claim 28, wherein the stator laminations (1, 2, 3, 4) are projection-welded to the holder (11) of the non-magnetic metal.

30. (new) The electric motor as claimed in claim 26, wherein the non-magnetic metal is brass.

31. (new) The electric motor as claimed in 26, wherein the non-magnetic metal is a non-ferrous metal or a non-ferrous metal alloy.

32. (new) The electric motor as claimed in claim 26, wherein the stator laminations (1, 2, 3, 4) form the stator which centrally has an opening (18) for receiving the rotor (19), individual said stator laminations (1, 2, 3, 4) being arranged around the opening (18).

33. (new) The electric motor as claimed in claim 32, wherein pairs of opposite said stator laminations (1, 2, 3, 4) are bent in relation to one another such that they receive a coil (23, 24).

34. (new) The electric motor as claimed in claim 33, wherein it has four stator laminations (1, 2, 3, 4) and two coils (23, 24).

35. (new) The electric motor as claimed in claim 34, wherein two opposite said stator laminations (1, 2) are cranked once in relation to each other such that parts of the stator laminations (1, 2) are aligned parallel to each other, between which parts a first of said two coils (23) is arranged in a magnetically coupled manner.

36. (new) The electric motor as claimed in claim 35, wherein two other opposite stator laminations (3, 4) have in a vicinity of the opening (18) a first crank and in a

vicinity of free ends a second crank and a second of said two coils (24) is arranged in a magnetically coupled manner between the free ends.

37. (new) The electric motor as claimed in claim 36, wherein the coils (23, 24) are arranged axially parallel at one height.

38. (new) The electric motor as claimed in claim 26, wherein the holder (11) has at least one foot (13) for mechanically fixing the stator at a place where the stator is fitted.

39. (new) The electric motor as claimed in claim 38, wherein the foot (13) is crankable after fitting of the stator for fixing the stator.

40. (new) The electric motor as claimed in claim 38, wherein the stator is fixable in a housing.

41. (new) The electric motor as claimed in claim 26, wherein one stator lamination (1) has an opening (8) into which a positioning pin protrudes.

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42. (new) The electric motor as claimed in claim 41, wherein the positioning pin is arranged in a housing.

43. (new) The electric motor as claimed in claim 26, wherein the stator laminations (1, 2, 3, 4) have at their ends facing the coils (23, 24) flattened portions (6) for facilitating fitting of the coils (23, 24).

44. (new) The electric motor as claimed in claim 26, wherein the rotor (19) is connected to a worm drive (22) which drives a spur gear (26).

45. (new) A process for producing an electric motor with a rotor and a stator, comprising a plurality of coils and stator laminations which are magnetically separated from one another and respectively extend from the coils to the rotor, the stator laminations (1, 2, 3, 4) are connected in a region facing the rotor (19) to a holder (11) of non-magnetic metal, the stator laminations (1, 2, 3, 4) being connected in a region facing the rotor (19) to a holder (11) of non-magnetic metal and are connected to one another by at least one web (5), the process comprising the steps of producing the stator laminations as one workpiece (W), wherein the workpiece (W) is connected to the holder (11) of the non-magnetic metal and the at least one web (5) between or on the stator laminations (1, 2, 3, 4) being cut through and/or removed completely.

46. (new) The process as claimed in
claim 45, wherein the connection of the stator laminations (1, 2,
3, 4) to the holder (11) takes place by soldering, adhesive
bonding and riveting.

47. (new) The process as claimed in
claim 45, wherein the stator laminations (1, 2, 3, 4) are welded
to the holder (11) of the non-magnetic metal, the connection
takes place by welding.

48. (new) The process as claimed in
claim 47, wherein the welding is performed as projection welding,
boss-shaped projections (12) being formed in the holder (11) and
a required welding current being chosen such that atoms of the
holder (11) migrate into a zinc layer of the pole laminations (1,
2, 3, 4) without altering the structure of remaining metal of the
pole laminations.

49. (new) The process as claimed in
claim 45, wherein the one or more webs (5) between stator
surfaces are cut through by punching and/or removed completely.

50. (new) The process as claimed in
claim 45, wherein the workpiece (W) and the holder (11) are

positioned with one another by a pin passed through centering openings (10, 17).

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R E M A R K S

This Amendment accompanying this application is being made to cancel claims 1-25 without prejudice or disclaimer of the subject matter therein and to substitute new claims 26-50 therefor, in order to avoid multiple-dependent claim fees and to place this application in proper form and condition for examination as of the filing of this national stage application. No multiple-dependent claim fees apply.

Therefore no multiple-dependent claim fees should be charged in this application.

The specification has also been amended for formal improvement to comply with USA practice.

An Abstract is presented on a separate page herewith.

The Examiner is respectfully requested to enter this Amendment prior to calculation of the filing fee as of the national stage filing date, and to provide an action on the merits.

Respectfully submitted
Heinrich-Jochen Blume, et al

by: _____

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USA PCT National Stage Patent Application
PCT/EP99/09885 filed December 14, 1999
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MULTIPOLE ELECTRIC MOTOR AND
PROCESS FOR ITS PRODUCTION
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Multipole electric motor and process for its production

Abstract

A multipole electric motor with a rotor and a stator, with a plurality of coils and stator laminations (1, 2, 3, 4) which are magnetically separated from one another and respectively extend from the coils to the rotor. The stator laminations (1, 2, 3, 4) are connected in a region facing the rotor to a holder (11) of non-magnetic metal. A process for producing this electric motor, wherein the stator laminations (1, 2, 3, 4), connected to one another by one or more webs (5), are produced as one workpiece, and wherein the workpiece is connected to the holder (11) of non-magnetic metal and the web or webs between or on the stator laminations (1, 2, 3, 4) are cut through and/or removed completely.

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Multipole electric motor and process for its production**Description**

5 The invention relates to a multipole electric motor with a rotor and a stator, comprising a plurality of coils and stator laminations which are magnetically separated from one another and respectively extend from the coils to the rotor, and to a process for its
10 production.

Multipole electric motors with a plurality of stator laminations and with two or more coils as the stator and with a cylindrical permanent magnet formed as the rotor, which has at least two magnetic poles, 15 are known from practice. In the case of these electric motors, a stator lamination is respectively disposed from each end of the coil to the rotor, where it is situated a very small distance away from the permanent magnet. In the production of the known electric 20 motors, the stator laminations are individually fastened to the ends of the coil and the coils are subsequently fitted in the housing of the electric motor. In the case of these known electric motors, it is disadvantageous that, to produce electric motors with 25 identical electrical and mechanical properties, the positioning of the stator laminations with respect to the rotor is very laborious. If the stator laminations are at the wrong distance from one another or from the rotor, in the worst case the rotor may lock and the 30 electric motor may fail as a consequence.

The invention therefore has the object of specifying a multipole electric motor in which the stator laminations are positioned particularly precisely with respect to the permanent magnet and which can be produced in a simple manner and the object 35 of specifying a process for its production.

These objects are achieved on the one hand in the case of an electric motor according to the invention by the stator laminations being connected in

5 a region facing the rotor to a holder of non-magnetic metal. This allows them to be positioned easily with respect to one another. It is advantageous in this case that the positioning by the holder is also permanent. In the case of the production process according to the invention, the stator laminations of a motor, connected to one another by one or more webs, are produced as one workpiece and connected to the non-magnetic metallic holder and then the web or webs is or 10 are removed and/or cut through.

15 By galvanizing the stator lamination, the corrosion resistance of the electric motor is increased. Furthermore, a galvanized lamination can be projection-welded to the non-magnetic holder in such a way that individual zinc atoms and individual atoms of the non-magnetic holder form a common structure and, as a result, the stator laminations are permanently connected to the holder without altering the iron structure of the stator laminations. Projection 20 welding also has the advantage that a stable connection with small dimensions is established.

25 Finally, projection welding has the advantage that the working step requires only a short time and the workpiece produced by the welding can be further processed immediately.

Of course, adhesive bonding or soldering of the stator laminations to the holder is also possible in principle, but the time required for this is greater than the time required for projection welding.

30 Brass has been found to have particularly good properties for being worked as the non-magnetic metal, with at the same time adequate stability.

35 The fact that the stator laminations form a stator which centrally forms an opening for receiving the rotor allows a compact electric motor to be constructed. In this type of configuration, a simply constructed distribution of the magnetic force vectors occurring can be achieved by pairs of opposite stator laminations which are respectively bent in such a way

that they can receive a coil.

In its simplest form, such an electric motor has two coils and four stator laminations. An electric motor of this type can be realized in a particularly 5 compact form if two of the opposite stator laminations are in each case cranked once in such a way that one of the coils is arranged between their free ends in such a way that it is magnetically coupled with the stator laminations.

10 The form of the electric motor described above becomes even more compact if the two other opposite stator laminations have in the vicinity of the opening a first crank and in the vicinity of the free ends a second crank in such a way that the second coil is 15 arranged between their free ends in a manner magnetically coupled with the stator laminations. In particular, a gear mechanism can then be realized in a simple way by a worm drive which can interact with a spur gear being arranged on the shaft of the rotor.

20 If the holder has a foot for mechanically fixing the stator at the place where the stator is fitted, the stator as a whole can be fastened easily. This fastening becomes particularly easy if the holder can be cranked for fixing, in particular once the foot 25 has been inserted through an opening provided for this purpose in the housing of the electric motor.

The stator can be positioned easily and reliably in the housing or on a base plate through an opening in a stator lamination into which a positioning 30 pin, for example of a housing, protrudes, in particular in combination with the design of the holder last described.

The stator laminations can be separated particularly easily from the web or the webs if they 35 are cut through by punching and/or are removed completely.

The stator laminations can be positioned particularly easily and precisely on the holder through centering openings in the holder and in the workpiece

comprising the stator laminations and the connecting web or the connecting webs.

The invention is explained in more detail below for a particularly preferred exemplary embodiment on the basis of the figures, in which:

Figure 1 shows a view of a workpiece comprising four stator laminations which have not yet been cranked and are still connected to one another via a web.

Figure 2 shows a view of a holder.

10 Figure 3 shows a view of the holder from figure
2 connected to the workpiece from figure 1.

Figure 4 shows a view of the stator laminations and of the holder from figure 3 after their punching and the cranking of the stator laminations.

15 Figure 5 shows a perspective rear view of the
stator laminations and of the holder from figure 4.

Figure 6 shows a perspective view of the stator laminations and of the holder from figure 4 in interaction with a rotor.

20 Figure 7 shows the view and the partial section through an electric motor which has the components from figure 6.

In figure 1, a workpiece W has the stator laminations 1, 2, 3, 4 and a web 5, which connects the stator laminations 1, 2, 3, 4 to one another. The workpiece W is, for example, punched out from galvanized steel plate. The stator laminations 1, 2, 3, 4 have in each case a flattened portion 6 for the easy fitting of coils, described later, arranged between pairs of stator laminations 1, 2 and 3, 4, respectively. In the case of each stator lamination 1, 2, 3, 4, the positions of pairs of weld points 7 for connecting to a holder, to be described later, are represented. The stator lamination 1 has an opening 8 in the form of an elongate hole for receiving a positioning pin, which may be arranged for example in a housing.

A double circle 9, drawn in dashed lines, shows the limiting regions between the web 5 and the stator

laminations 1, 2, 3, 4. The web 5 also has a round centering opening 10 and four indentations 5a.

In figure 2, a holder 11, which is for example punched from brass plate, has eight round boss-shaped 5 projections 12, two feet 13, four radially bent elongate holes 14, four webs 15, which interrupt the elongate holes 14, and a center piece 16 with a centering opening 17.

In figure 3, the holder 11 is connected to the 10 workpiece W by eight projection welds, which are located between the boss-shaped projections 12 and the positions of the weld points 7 lying thereunder, not visible in figure 3, of the stator laminations 1, 2, 3, 4. Before the welding, the holder 11 and the workpiece 15 W may be centered with one another by a pin, which is passed through the centering opening 17 of the holder 11 and the centering opening 10 lying thereunder of the workpiece W. Depending on the nature of the pin, the 20 diameters of the centering openings 10, 17 have the same dimensions, if the pin is of a cylindrical form, or different dimensions, if the pin is of a tapered form. The centering openings 10, 17 may also be of a polygonal shape.

To obtain the opening 18 represented in figure 25 4 for receiving the rotor, to be described later, the web 5 has been removed from the workpiece W and the center piece 16 with the webs 15 have been removed from the holder 11. The stator laminations 1, 2, 3, 4 are consequently magnetically separated from one another. 30 The removal of the web 5, the center piece 16 and the webs 15 can be advantageously performed by punching out the parts to be removed, it also being possible for the centering opening 17 to serve as a positioning aid for the tool required for the punching. In figure 4, web 35 stumps 15a of the otherwise removed webs 15 can still be seen. The fact that, in the case of the holder 11, only the webs 15 have to be cut through and not the entire circumference of the opening 18, means that the holder 11 and the welds on the stator laminations 1, 2,

3, 4 are subjected to less loading by this punching operation and the holder 11 is not deformed. In figure 4, the stator laminations 1, 2, 3, 4 have also already been bent into their final position.

5 The perspective view in figure 5 shows the rear view of the stator laminations 1, 2, 3, 4 represented in figure 4, with the holder 11. It can be seen that the ends of the stator laminations 1, 2, arranged on the holder 11, and of the stator laminations 3, 4 respectively lie opposite one another and that the stator laminations 1, 2 are each cranked once and the stator laminations 3, 4 are each cranked twice in such a way that a coil (not represented) can be arranged in each case between the stator laminations 1, 2 and 3, 4, 10 respectively, with the flattened portions 6 of the stator laminations 1, 2, 3, 4 facilitating fitting. 15

In the case of the perspective view in figure 6, in the opening 18 there can be additionally seen a diametrically magnetized rotor 19, which is rotatably 20 mounted by means of a rotor shaft in two bearings, of which the bearing 21 is represented. On the rotor shaft 20, a worm drive 22 is securely connected to the rotor.

In the case of the perspective view with a 25 partial section of an exemplary embodiment of a complete electric motor according to the invention, the position of the view of the stator laminations 1, 2, 3, 4 and of the holder 11 approximately coincides with the position of the view of these parts in figure 5. A 30 coil 23 is arranged between the ends of the stator lamination 2 and the stator lamination 1, which cannot be seen, and is magnetically coupled to them. Similarly, a coil 24 is arranged between the ends of the stator laminations 4, 3, the view of the end of the 35 stator lamination 3 being concealed in figure 7 by a lower housing part 25. The motor can be operated as a stepping motor, for example by activating the coils 23, 24 with current pulses, or as a synchronous motor, by activating the coils 23, 24 with sinusoidal currents

offset by 90°.

The worm drive 22 is in effective connection with a spur gear 26, which is rotatably mounted by means of a shaft 27. A further part of a gear mechanism for example can be fitted onto the shaft 27. It is also possible to fit an indicator onto the shaft 27 and in this way realize a measuring mechanism, in particular when the motor is activated as a stepping motor. The stepping down of the rotary steps of the motor by the gear mechanism comprising the worm drive 22 and the spur gear 26 additionally allows the resolution to be increased. The prescribed motor can be protected against environmental influences by an upper housing part 28, which is advantageously able to be fastened on the lower housing part 25 by means of a clip 29. Finally, the electric motor described above can be fastened easily, quickly and permanently on a printed circuit board, not represented, for example by means of an engaging element 30.

Multipole electric motor and process for its production**Patent claims**

5 1. A multipole electric motor with a rotor and a stator, comprising a plurality of coils and stator laminations which are magnetically separated from one another and respectively extend from the coils to the rotor, characterized in that the stator laminations (1, 2, 3, 4) are connected in a region facing the rotor (19) to a holder (11) of non-magnetic metal.

10 2. The electric motor as claimed in claim 1, characterized in that the stator laminations (1, 2, 3, 4) are galvanized.

15 3. The electric motor as claimed in claim 2, characterized in that the stator laminations (1, 2, 3, 4) are welded to the holder (11) of non-magnetic metal.

4. The electric motor as claimed in claim 3, characterized in that the stator laminations (1, 2, 3, 4) are projection-welded to the holder (11) of non-magnetic metal.

20 5. The electric motor as claimed in one of the preceding claims, characterized in that the non-magnetic metal is brass.

25 6. The electric motor as claimed in one of claims 1 to 4, characterized in that the non-magnetic metal is a non-ferrous metal or a non-ferrous metal alloy.

7. The electric motor as claimed in one of the preceding claims, characterized in that the stator laminations (1, 2, 3, 4) form a stator which centrally has an opening (18) for receiving the rotor (19), the individual stator laminations (1, 2, 3, 4) being arranged around the opening (18).

30 8. The electric motor as claimed in claim 7, characterized in that pairs of opposite stator laminations (1, 2, 3, 4) are bent in relation to one another in such a way that they receive a coil (23, 24).

35 9. The electric motor as claimed in claim 8,

characterized in that it has four stator laminations (1, 2, 3, 4) and two coils (23, 24).

10. The electric motor as claimed in claim 9, characterized in that two opposite stator laminations (1, 2) are cranked once in relation to each other in such a way that parts of the stator laminations (1, 2) are aligned parallel to each other, between which parts the first coil (23) is arranged in a magnetically coupled manner.

10 11. The electric motor as claimed in claim 10, characterized in that the two other opposite stator laminations (3, 4) have in the vicinity of the opening (18) a first crank and in the vicinity of the free ends a second crank and the second coil (24) is arranged in 15 a magnetically coupled manner between the free ends.

12. The electric motor as claimed in claim 11, characterized in that the coils (23, 24) are arranged axially parallel at one height.

20 13. The electric motor as claimed in one of the preceding claims, characterized in that the holder (11) has at least one foot (13) for mechanically fixing the stator at the place where the stator is fitted.

14. The electric motor as claimed in claim 13, characterized in that the foot (13) can be cranked 25 after fitting of the stator for fixing the stator.

15. The electric motor as claimed in claim 13 or 14, characterized in that the stator can be fixed in a housing.

30 16. The electric motor as claimed in one of the preceding claims, characterized in that one stator lamination (1) has an opening (8) into which a positioning pin protrudes.

17. The electric motor as claimed in claim 16, characterized in that the positioning pin is arranged 35 in the housing.

18. The electric motor as claimed in one of the preceding claims, characterized in that the stator laminations (1, 2, 3, 4) have at their ends facing the coils (23, 24) flattened portions (6) for facilitating

fitting of the coils (23, 24).

19. The electric motor as claimed in one of the preceding claims, characterized in that the rotor (19) is connected to a worm drive (22) which drives a spur gear (26).

5 20. A process for producing the electric motor as claimed in one of the preceding claims, characterized in that the stator laminations (1, 2, 3, 4), connected to one another by one or more webs (5), are produced as one workpiece (W), characterized in that the workpiece (W) is connected to the holder (11) of non-magnetic metal and the web or webs (5) between or on the stator laminations (1, 2, 3, 4) are cut through and/or removed completely.

10 15 21. The process as claimed in claim 20, characterized in that the connection of the stator laminations (1, 2, 3, 4) to the holder (11) takes place by soldering, adhesive bonding and riveting.

20 22. The process as claimed in claim 20 for producing an electric motor with the features of claim 3, characterized in that the connection takes place by welding.

25 23. The process as claimed in claim 22, characterized in that the welding is performed as projection welding, boss-shaped projections (12) being formed in the holder (11) and a required welding current being chosen such that atoms of the holder (11) migrate into the zinc layer of the pole laminations (1, 2, 3, 4) without altering the structure of the 30 remaining metal of the pole laminations.

24. The process as claimed in one of claims 20 to 23, characterized in that the web or webs (5) between the stator surfaces are cut through by punching and/or removed completely.

35 25. The process as claimed in one of claims 20 to 24, characterized in that the workpiece (W) and the holder (11) are positioned with one another by a pin passed through the centering openings (10, 17).

Multipole electric motor and process for its production

Abstract

In the case of a multipole electric motor with a rotor and a stator, comprising a plurality of coils and stator laminations (1, 2, 3, 4) which are magnetically separated from one another and respectively extend from the coils to the rotor, it is provided that the stator laminations (1, 2, 3, 4) are connected in a region facing the rotor to a holder (11) of non-magnetic metal.

In the case of a process for producing the electric motor described above, it is provided that the stator laminations (1, 2, 3, 4), connected to one another by one or more webs (5), are produced as one workpiece, and that the workpiece is connected to the holder (11) of non-magnetic metal and the web or webs between or on the stator laminations (1, 2, 3, 4) are cut through and/or removed completely.

(Figure 5)

1 / 4

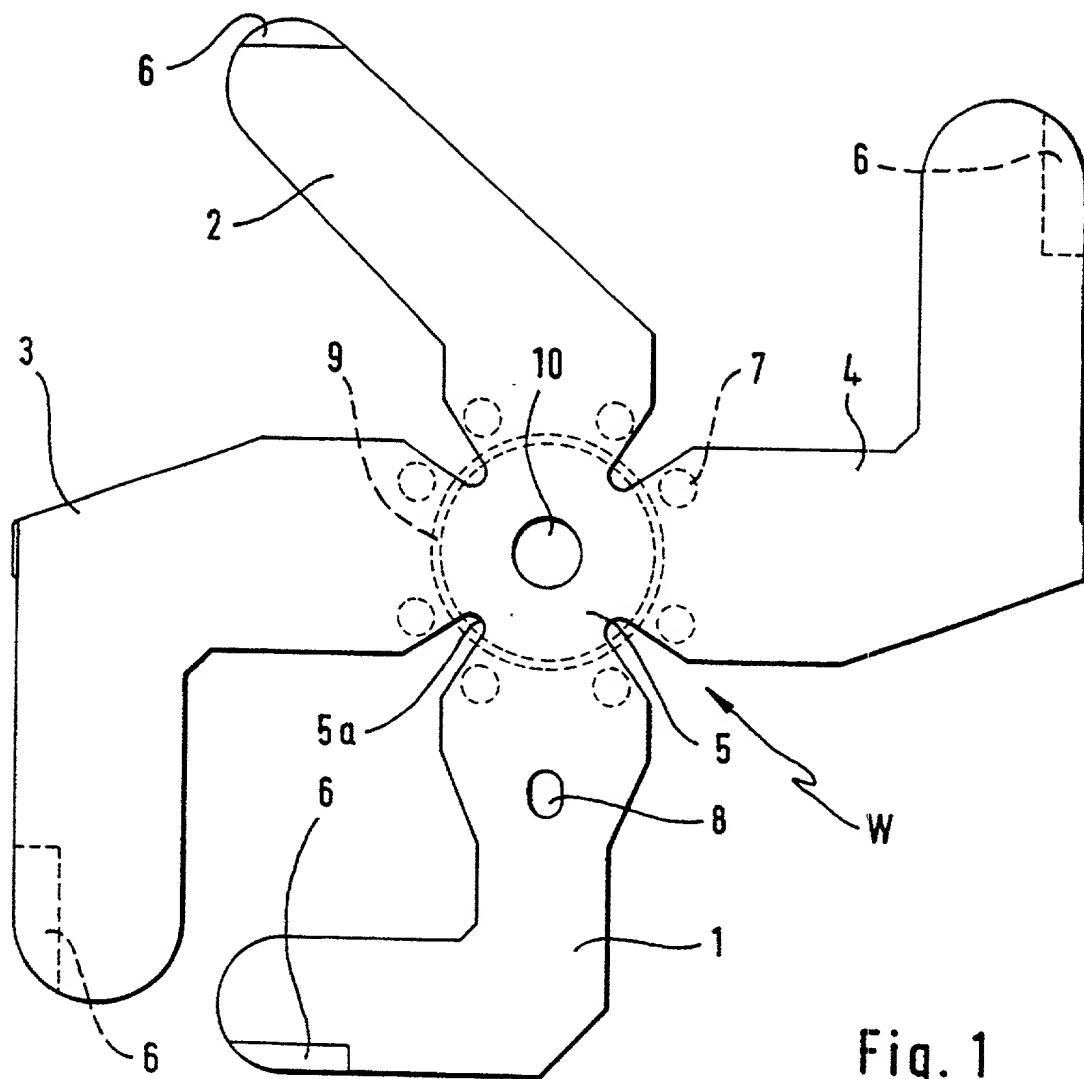


Fig. 1

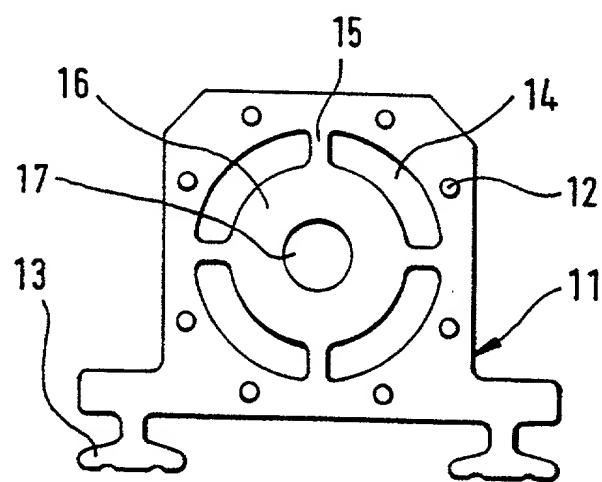


Fig. 2

2 / 4

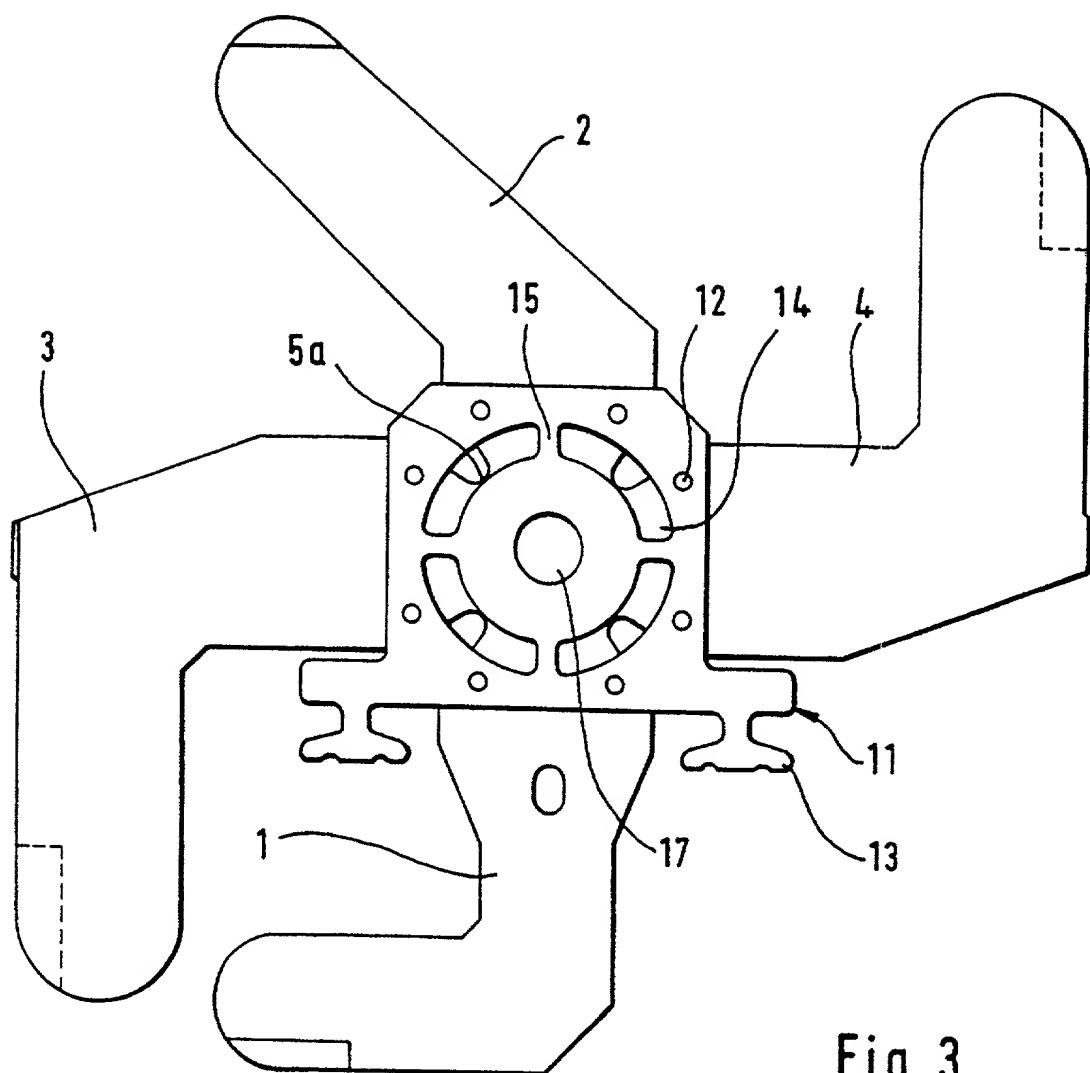


Fig. 3

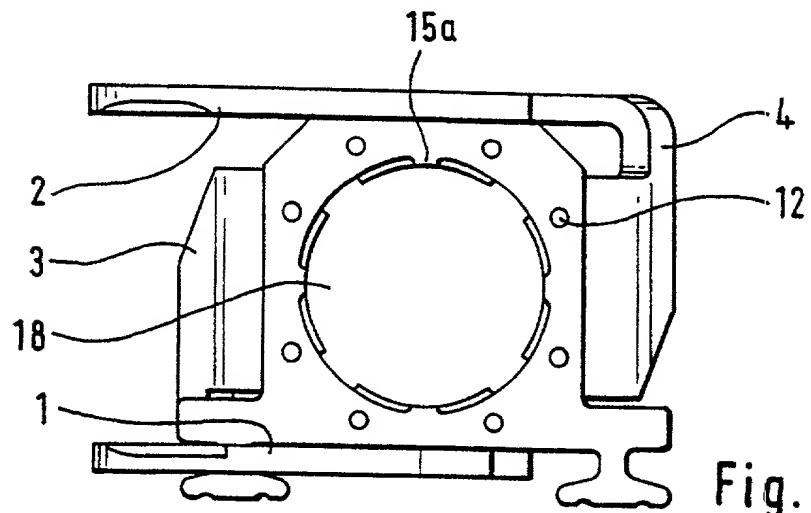


Fig. 4

3 / 4

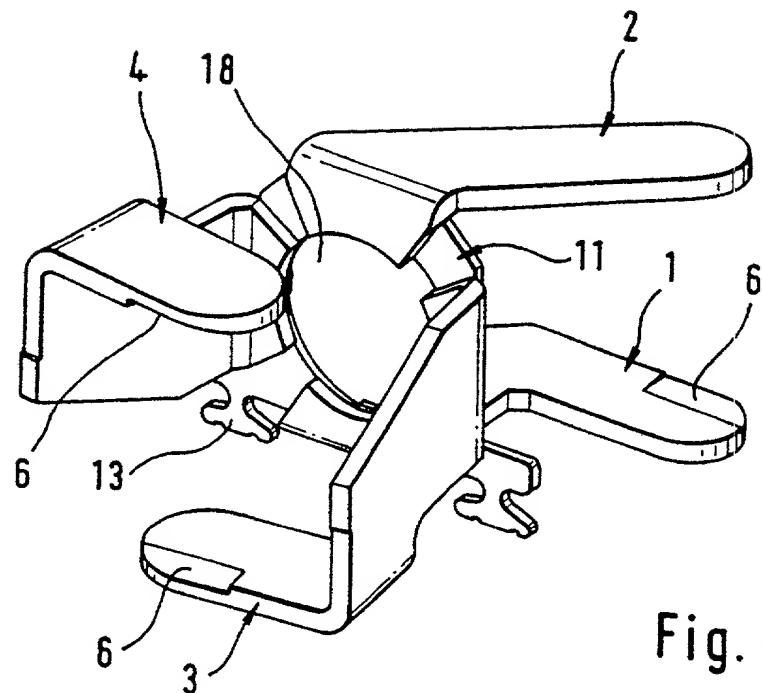


Fig. 5

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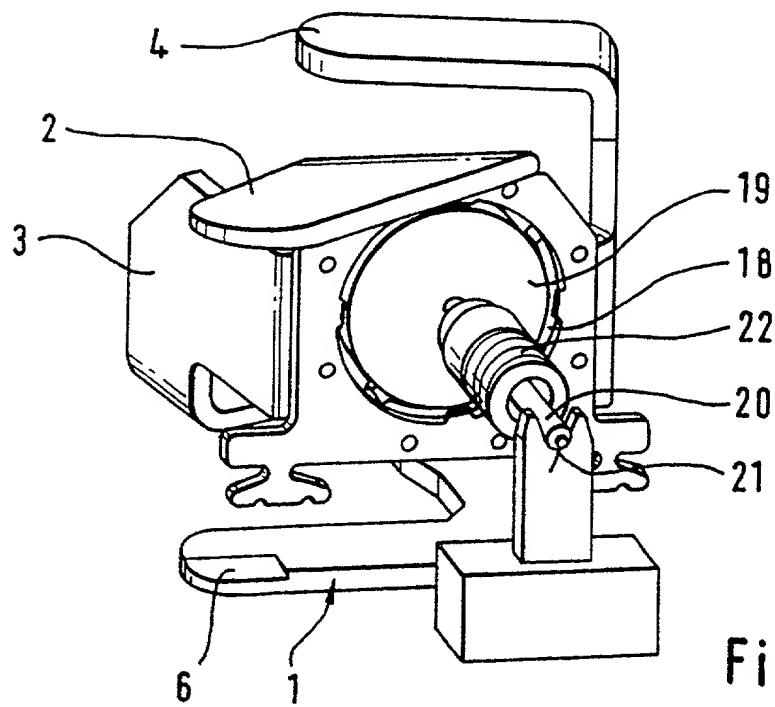


Fig. 6

4 / 4

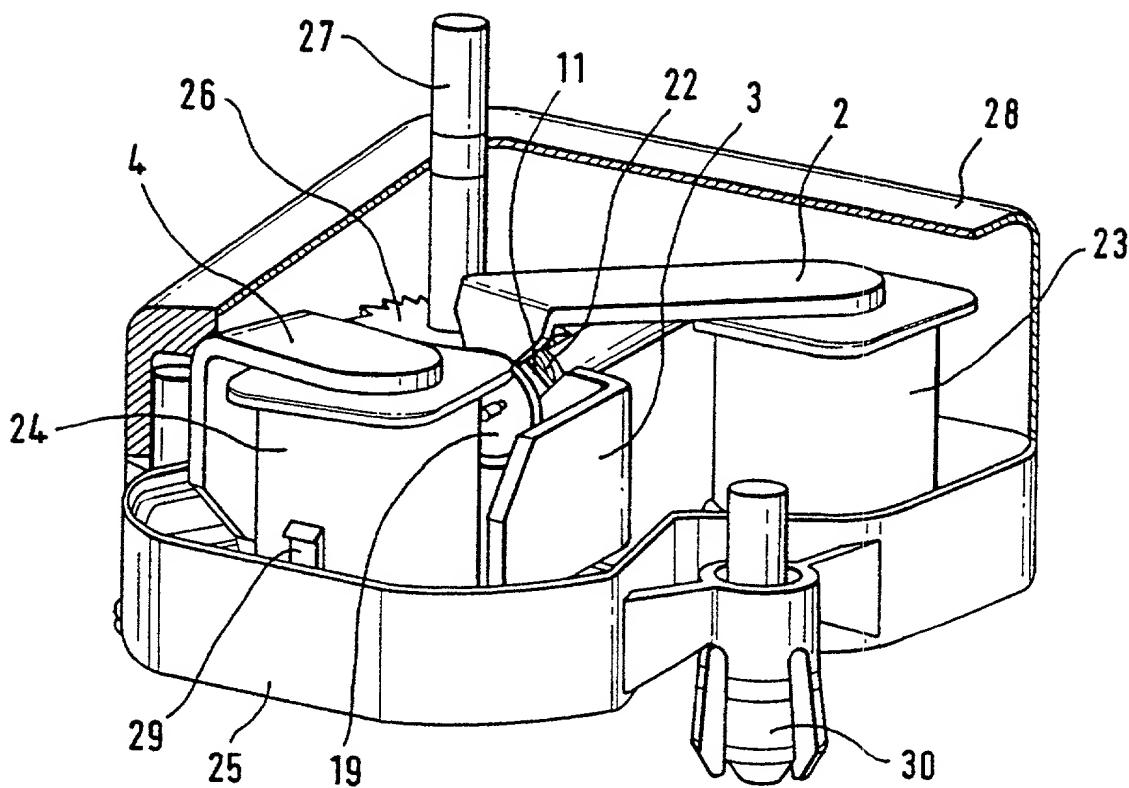


Fig. 7

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
 (Includes Reference to PCT International Applications)

ATTORNEY'S SOCIETY NUMBER

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

MULTIPOLE ELECTRIC MOTOR AND PROCESS FOR ITS PRODUCTION

the specification of which (check only one item below):

is attached hereto.
 was filed as United States application

Serial No. _____

on _____

and was amended

on _____ (if applicable).

was filed as PCT international application

Number PCT/EP99/09885

on December 14, 1999

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (If PCT indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day month year)	PRIORITY UNDER 35 USC 119
Germany	198 60 111.5	23/12/1998	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

Combined Declaration For Patent Application and Power of Attorney (Continued)
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ATTORNEY'S SIGNATURE
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35 U.S.C. 120:

U.S. APPLICATIONS

U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.

PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBER ASSIGNED OR FILED

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number) MARTIN A. FARBER, Esq., Reg. No. 22,345

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Zeder

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28.5.01

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X Christian Beckhaus

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SIGNATURE OF INVENTOR 203

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DATE

Combined Declaration For Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications)

ATTORNEY • SOLICITOR GENERAL
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PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER
35 U.S.C. 120:

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number) MARTIN A. FARBER, Esq., Reg. No. 22,345
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	POST OFFICE ADDRESS	CITY	CITY	STATE & ZIP CODE/COUNTRY
204	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP <u>CITY</u>	CITY <u>CITY</u>	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201 	SIGNATURE OF INVENTOR 202 	SIGNATURE OF INVENTOR 203 
DATE 29.5.03	DATE	DATE